



MULTILIN

GE Power Management

SR745



Transformer

Management Relay™

SR745

Transformer

Management

Relay™





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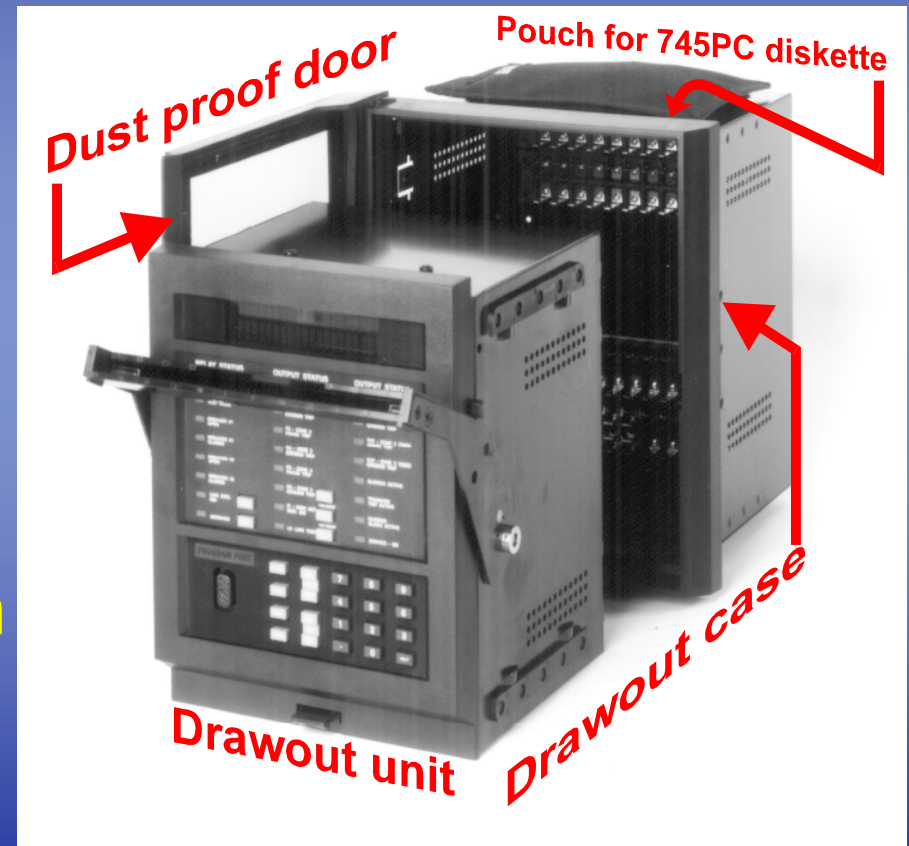
SR745

- *Description*
- *Protection*
- *Flexibility*
- *Metering/Monitoring*
- *Inputs/Outputs*
- *745PC/Communications*
- *Scheme Logic*
- *Planned features/Testing*
- *Ordering*



745 Description

- High Speed
- Multi-processor
- For 3 or 2 winding Transformers
- Primary or backup protection
- Small, Medium and High power transformers
- Drawout
- Adaptive

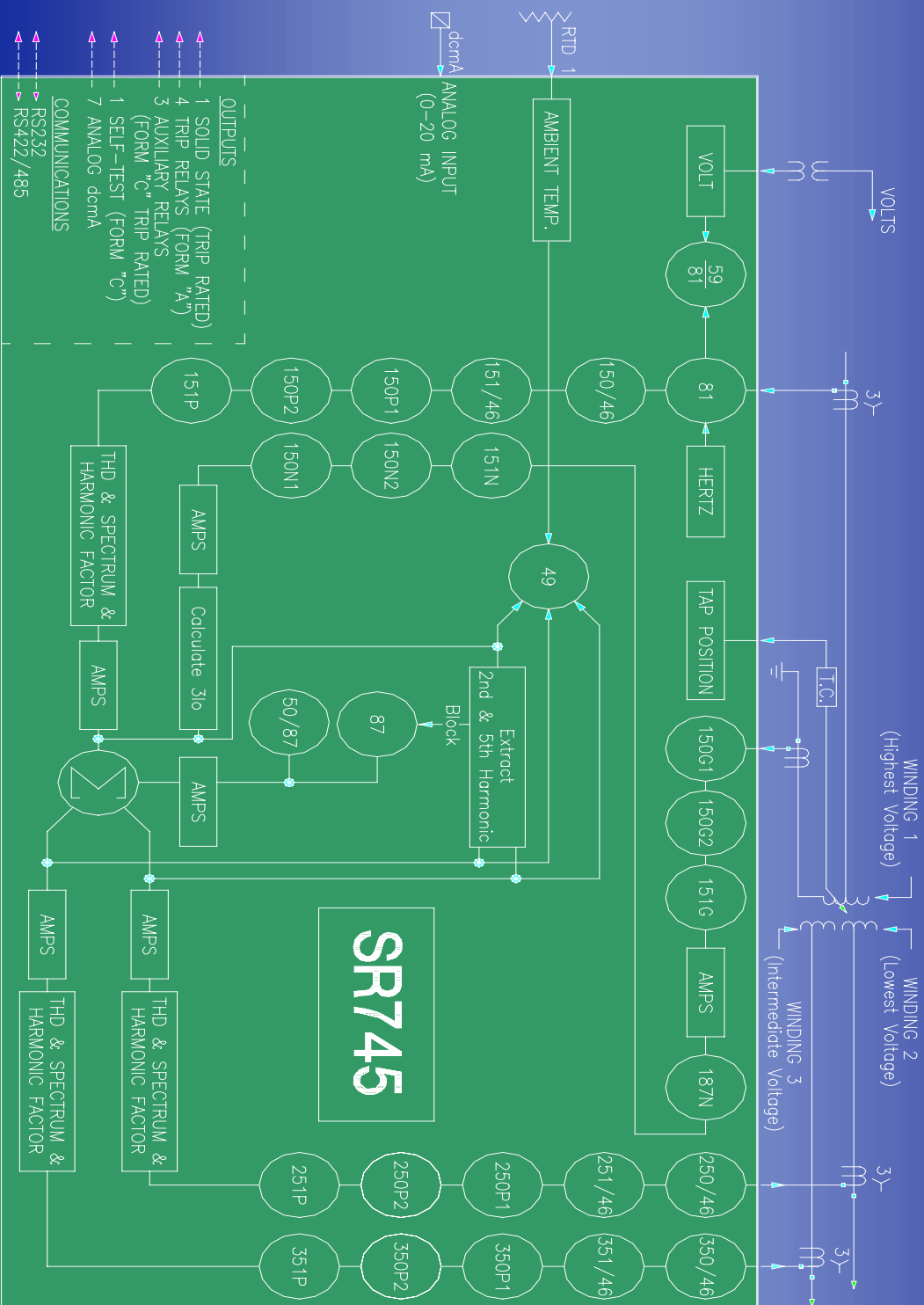




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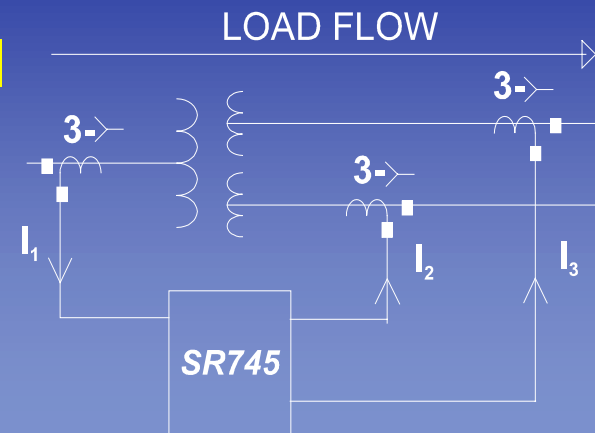
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SR745 Description, One-Line Diagram



745 Protection - Differential

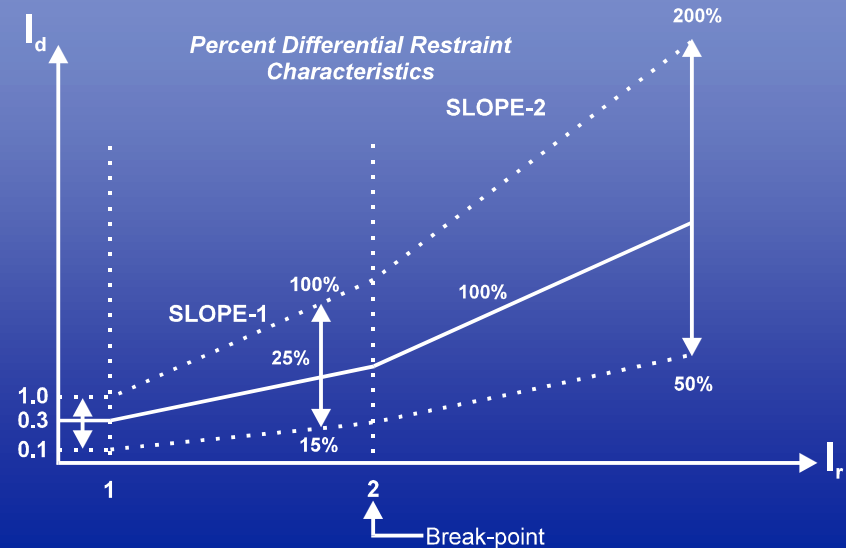
- Variable dual-slope percent differential (87T)
 - Slope1: 15% to 100%
 - Slope2: 50% to 200%
- Inrush blocking via *Harmonic restraint*
 - Programmable thresholds for:
 - 2nd , or 2nd+ 5th harmonics
 - 5th harmonic
 - Harmonic Cross-Phase Averaging
- Instantaneous unrestrained per phase differential (87/50)



$$I_r = I_{\text{restraint}} = \frac{|I_1| + |I_2| + |I_3|}{3}$$

$$I_d = I_{\text{differential}} = |I_1 - I_2 - I_3|$$

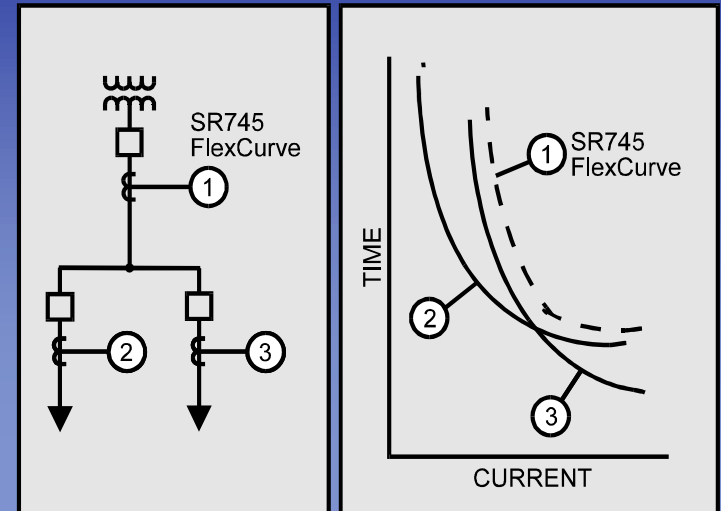
$$\% \text{SLOPE} = (I_{\text{differential}} / I_{\text{restraint}}) \times 100\%$$



745 Protection - Overcurrent

- **Phase Overcurrent - per winding**
 - Instantaneous (50P) - 2 levels
 - Timed (51P)
- **Ground Overcurrent - per WYE winding**
 - Instantaneous (50N) - 2 levels
 - Timed (51N)
- **Calculated Neutral Overcurrent - per WYE winding**
 - Instantaneous (50N) - 2 levels
 - Timed (51N)
- **Negative sequence overcurrent - per winding**
 - Instantaneous (46/50)
 - Timed (46/51)
- **Selectable time overcurrent curves**
 - 12 pre-defined (ANSI, IEC, IAC)
 - 2 user definable - custom built curves
 - Inst., or linear reset time characteristics

Typical Application of SR745 FlexCurve



ANSI Multiplier: 0.5 to 30	Extremely Inverse Very Inverse Normally Inverse Moderately Inverse Definite Time
IEC (BS142) Multiplier: 0.05 to 1.00	Curve A Curve B Curve C
IAC Multiplier: 0.5 to 30	Extremely Inverse Very Inverse Normally Inverse Moderately Inverse Definite Time
Custom Multiplier: 0.5 to 30	FlexCurve™ A FlexCurve™ B

745 Protection - Other

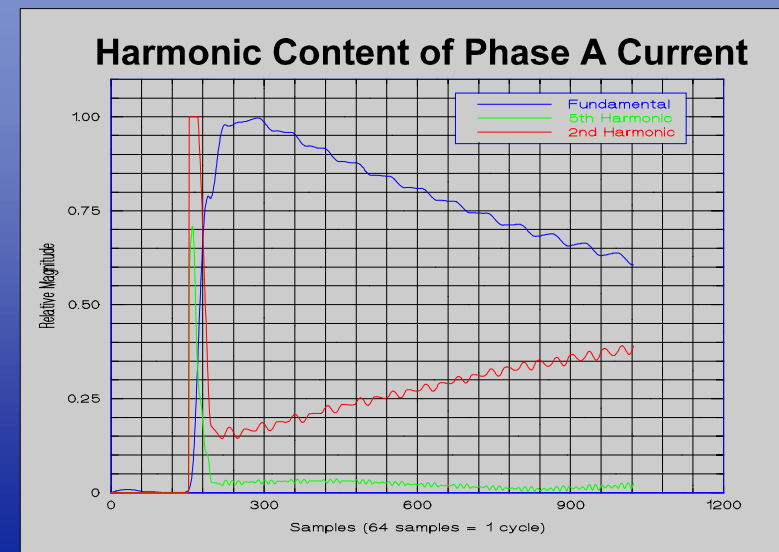
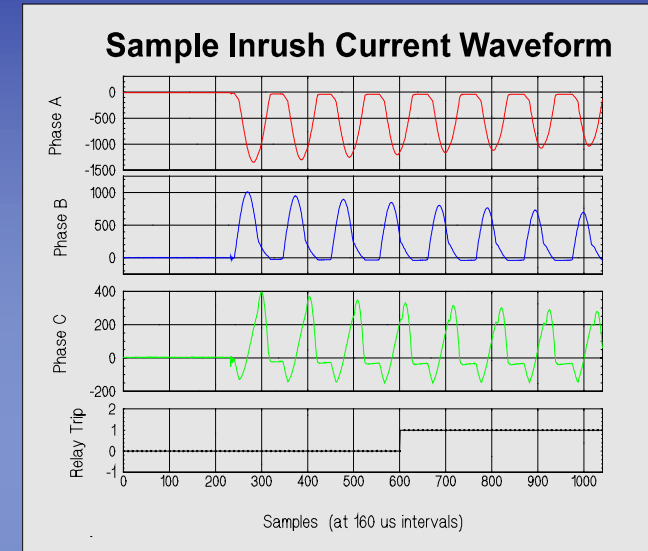
- **Frequency - Load Shedding**
 - Traditional load shedding
 - 2 Under-frequency elements (81)
 - Minimum operating current exceeded
 - Advanced load shedding
 - Frequency decay: 4 df/dt elements (59/81)
 - Minimum operating current exceeded
- **Over-excitation**
 - Overvoltage - power system disturbances
 - 5th harmonic level
 - Over-fluxing - unit transformer
 - 2 Volts-per-Hertz (Volts/Hz) elements
 - Minimum operating voltage exceeded
 - Time delay
- ***THD protection - per winding***
 - THD level / time delay
 - Minimum operating current
- ***Current Demand***
- ***Transformer Overload***

745 Enhanced flexibility

- **Auto Configuration**
 - Single setpoint for transformer type:
 - 116 transformer types to choose from
 - No vector transformation required
 - All CTs connected in WYE
 - SR745 corrects for:
 - Phase and magnitude
 - Zero sequence compensation
- **Dynamic CT Ratio mismatch correction**
 - Monitored through tap position
- **Multiple setpoint groups**
 - selected through:
 - Digital inputs
 - Communication
 - Front panel
 - 4 in-service setpoint groups
 - 1 test setpoint group
 - 1 group settings active at any one time

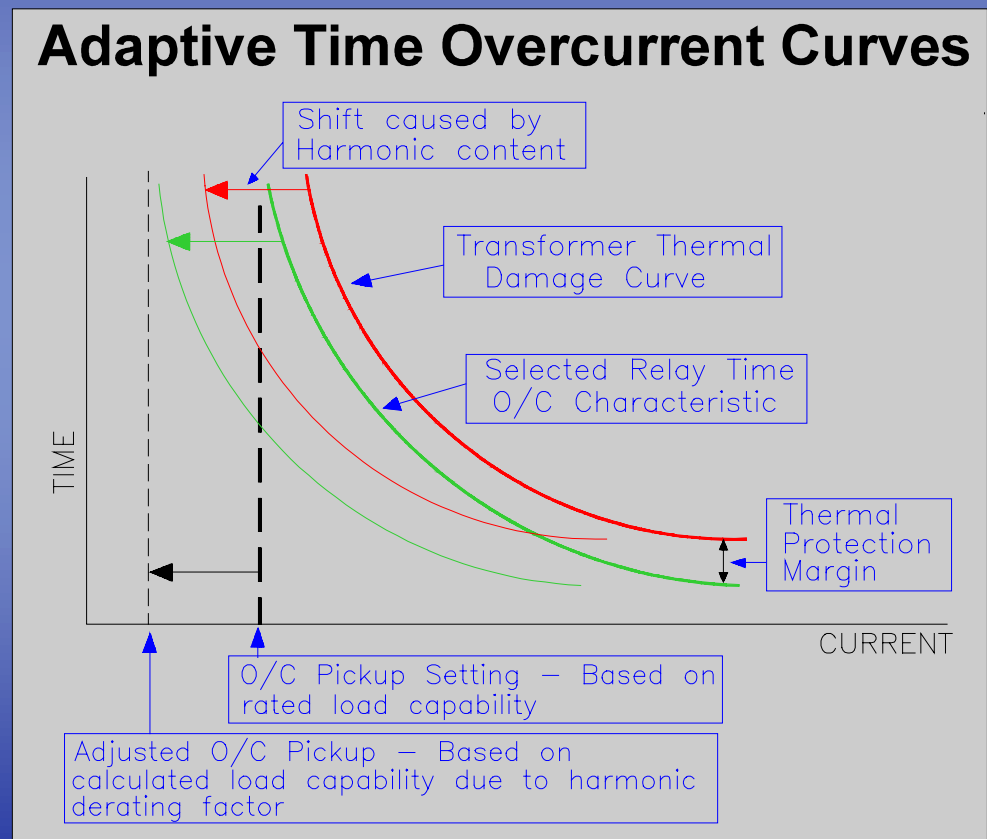
Flexibility - Adaptive Harmonic Restraint Energization inhibit

- Active only on energization
- Time delay (0.05 to 100 sec)
- 2nd harmonic restraint
- 2nd+5th harmonic restraint
- Cross-phase averaging
- Triggered by detection of transformer deenergization:
 - Phase current below programmable threshold
 - Breaker status through logic input
 - Voltage from any phase below programmable threshold



Enhanced flexibility - Adaptive Time O/C

- SR745 calculates Harmonic Factor - per winding
- Per ANSI/IEEE C57.110-1986
- Shifts curves and pickup levels to maintain transformer thermal protection



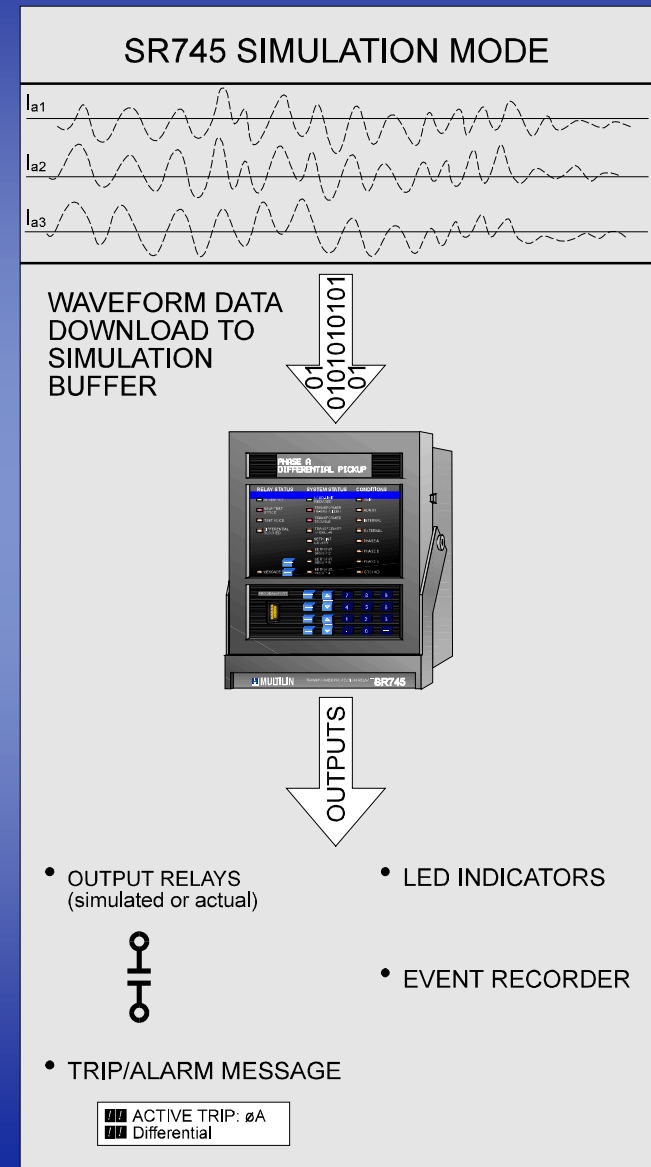


SR745 Enhanced Flexibility

- **Waveform Capture - Oscillography**
- 64 samples per cycle
- All inputs sampled simultaneously
- Capture magnitude and phase for all current inputs (Inrush & Fault)
- Programmable trigger
- Total of 16 cycles saved
- Programmable pre-trigger cycles
- Programmable post-trigger cycles

SR745 Enhanced Flexibility

- **Simulation Mode**
- Allows testing without external test equipment
- Allows input of waveforms to simulation buffer
- Allows playback of waveforms
- Accepts data files in IEEE "COMTRADE" format
- Suspends all A/D operations
- Process waveform in buffer
- simulation buffer = 11 channels x 16 cycles x 64 samples



745 Metering and Monitoring

- **Date & Time**
- **Logic inputs states**
 - **Open**
 - **Closed**
- **Output Relays states**
 - **Energized**
 - **De-energized**
- **Current-per winding-per phase (calculated every 1/2 cycle - display updated every 2 sec)**
 - **RMS of fundamental**
 - **Phase angle**

745 Metering and Monitoring

- **Sequence currents per winding**
 - **Positive / Angle**
 - **Negative / Angle**
 - **Zero / Angle**
- **Differential currents per phase / Angle**
- **Restraint currents per phase / Angle**
- **Up to the 21st harmonic per winding - per phase**
- **THD per winding**
- **Harmonic Derating factor per winding**

745 Metering and Monitoring

- **Frequency**
 - System
 - Frequency decay (df/dt)
- **Tap position**
- **Voltage**
 - System
 - Volts-per-Hertz (Volts/Hz)
- **Demand- per winding - per phase**
- **Maximum demand - time/date stamped - per winding - per phase**
- **Ambient temperature (RTD input)**

745 Metering and Monitoring

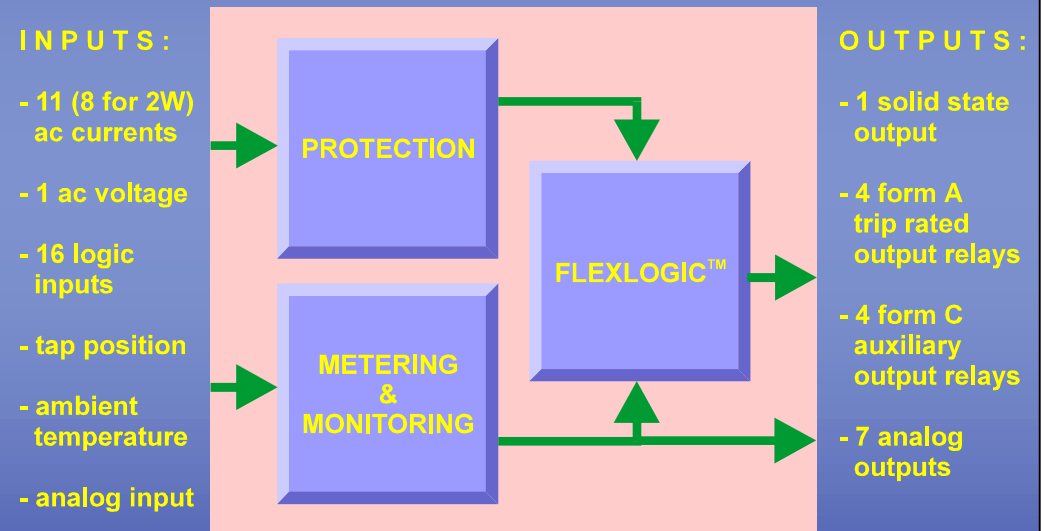
- **Up to 128 events**
 - Time / date stamped
 - Active setpoint group at time of event
- **SR745 revision**
 - Hardware
 - Software
- **Calibration Date**

745 inputs/outputs

SR745 TRANSFORMER MANAGEMENT RELAY

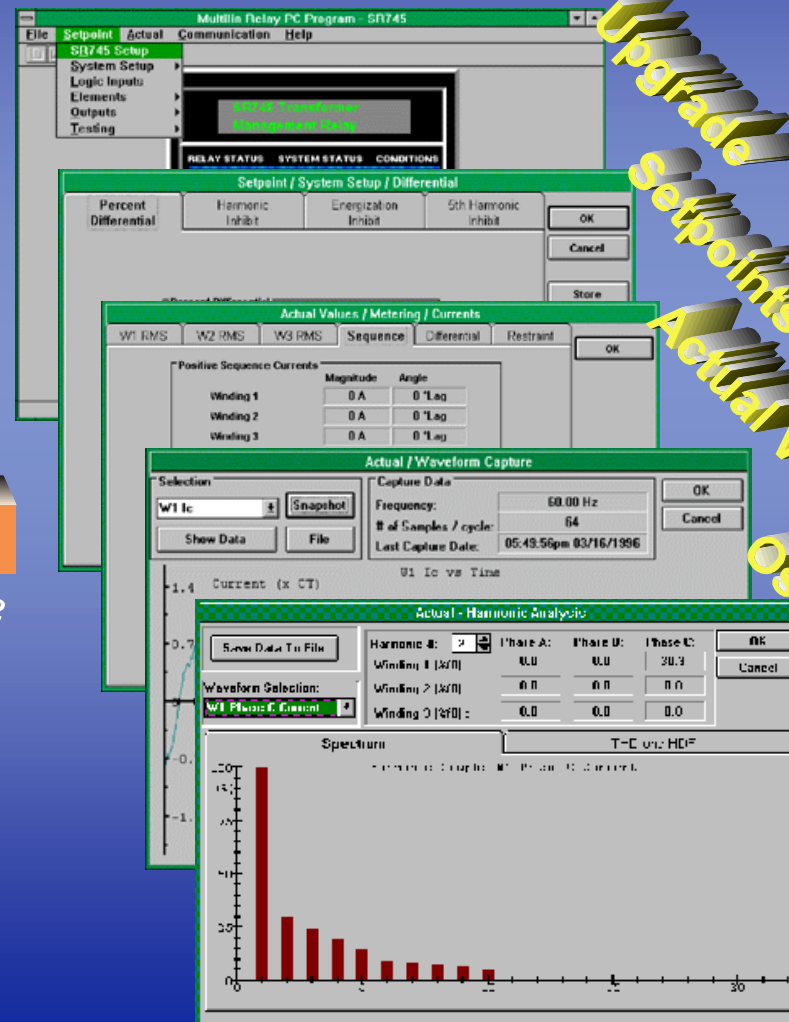
SYSTEM OVERVIEW

- 16 logic inputs
- Dry or wet (30 to 300 VDC)
- 1 analog input
- User selectable
 - 0-1,0-5,0-20,4-20 mA DC
- 7 analog outputs
- User selectable
 - 0-1,0-5,0-20,4-20 mA DC
 - Assignable to any metered parameter



745PC/Communications

- 3 serial ports
 - RS232 (front)
 - RS485 (back)
 - RS422 (back)
- Modbus RTU

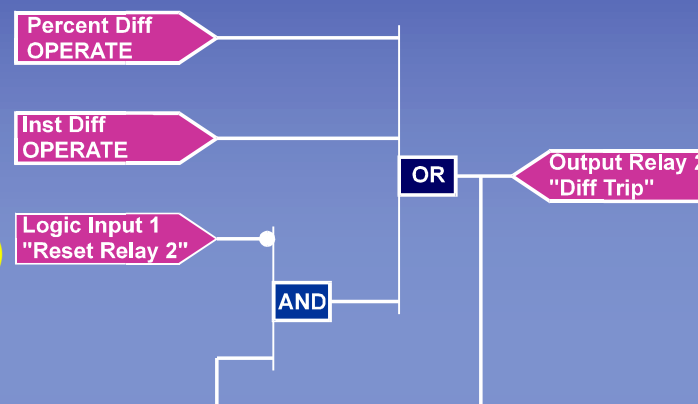


Upgrade
Setpoints
Actual Values
Oscillography
Harmonics



745 Scheme Logic

- FlexLogic™ is programmable logic
- FlexLogic™ equation =
 - Elements (pickup & operate)
 - Boolean gates (NOT,OR,AND...)
 - Logic inputs (1 to 16)
 - Output relays (1 to 8)
 - Virtual outputs (1 to 5)
 - Timers (1 to 10)
- One equation per output
- Outputs: Relays, Waveform capture trigger, Virtual outputs
- Accessible from:
 - Keypad
 - 745PC Windows program
 - *Future: Xpression Builder*



- 2 to 19 inputs for gates OR, AND, NOR, NAND, and XOR

Outputs	No. of parameters
Output relays	20
Waveform capture trigger	10
Virtual outputs	10

OUTPUT 2 NAME:	Diff Trip
OUTPUT 2 OPERATION:	Self-resetting
OUTPUT 2 TYPE:	Trip
OUTPUT 2 FLEXLOGIC O1:	Percent Diff OP
OUTPUT 2 FLEXLOGIC O2:	Inst Diff OP
OUTPUT 2 FLEXLOGIC O3:	Logic Input 1
OUTPUT 2 FLEXLOGIC O4:	NOT
OUTPUT 2 FLEXLOGIC O5:	Output Relay 2
OUTPUT 2 FLEXLOGIC O6:	AND (2 inputs)
OUTPUT 2 FLEXLOGIC O7:	OR (3 inputs)
OUTPUT 2 FLEXLOGIC O8:	END
:	
OUTPUT 2 FLEXLOGIC 20:	END

745 New features

- **Restricted earth fault**
- **Loss of life (ANSI/IEEE guide C57.92.981)**
- **Calculate up to 25th harmonic**
- **Power calculations**
- **Volts-per-Hertz inverse characteristics**
- **IRIG B - time synchronization**
- **Multiple waveform capture (4)**



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745 Order code

